Network Working Group Jon Postel
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Extensible Field Addressing

Introduction

This memo discusses the need for and advantages of the expression of addresses in a network environment as a set of fields. The suggestion is that as the network grows the address can be extended by three techniques: adding fields on the left, adding fields on the right, and increasing the size of individual fields. Carl Sunshine has described this type of addressing in a paper on source routing [1].

Motivation

Change in the Host-IMP Interface

The revised Host-IMP interface provides for a larger address space for hosts and IMPs [2]. The old inteface allowed for a 2 bit host field and a 6 bit IMP field. The new interface allows a 8 bit host field and a 16 bit IMP field. In using the old interface it was common practice to treat the two fields as a single eight bit quantity. When it was necessary to refer to a host by number a decimal number was often used. For example host 1 on IMP 1 was called host 65. Doug Wells has pointed out some of problems associated with attempting to continue such useage as the new interface comes into use [3]. If a per field notation had been used no problems would arise.

Some examples of old and new host numbers are:

Host Name	Host	IMP	old #	new #
SRI-ARC	0	2	2	2
UCLA-CCN	1	1	65	65537
ISIA	1	22	86	65558
ARPA-TIP	2	28	156	131100
BBNA	3	5	197	196613

Multinetwork Systems

The prospect of interconnections of networks to form a complex multinetwork system poses additional addressing problems. The new Host-IMP interface specification has reserved fields in the leader to

carry network addresses [2]. There is experimental work in progress on interconnecting networks [4, 5, 6]. We should be prepared for these extensions to the address space.

The addressing scheme should be expandable to increase in scope when interconnections are made between complex systems.

Multiprocessor Hosts

There may be configurations of hardware that could be interfaced to a network as a single host that in fact contain multiple processors. Tasks could be associated with processors such that it is desirable to dispatch network messages associated with certain sockets or message-ids to certain processors. For example it might be desirable to service all Telnet use from one processor and all FTP use from a different processor.

The addressing scheme should be expandable to explicitly address the fine structure within a host when that is desirable.

Some examples where such fine structure addressing would have been useful in the ARPANET are:

At ISI, we have the capability of emulating computers using the PRIM system [7]. For many applications it is desirable to add the emulated host to the network. Since the emulation is carried out under control of a program operating under Tenex, we have a host within a host. Extensible addressing of hosts would provide the necessary handle.

SCRL once had a PDP-11 connected by VDH to an IMP at UCSB. It became necessary to add a second PDP-11 to the network. The two PDP-11s were already physically connected and it would have been a simple matter to have the first serve as a multiplexor for both. However, because of the limitations in the network addressing structure, there was no way to identify the two hosts to other sites on the network. A new IMP had to be installed!

In many other cases, it is desirable to have two hosts share the same front end to the network. With the current limitation, one IMP port must be consumed for each host.

Proposal

The necessary solution to the problem posed by the change in the Host-IMP inteface is to always represent the address by fields. This solution provides for a natural growth into an internetwork environment, and allows explicit addressing of the fine structure within a host if that is desirable.

The fields should be written in a natural way, and i believe that means that the most general field should come first with additional fields specifying more and more details of the address. In the current case this would lead to the following fields:

Network / IMP / Host / Message-Identifier

A problem with simple field addressing is the desire to specify only the fields that are necessary given the local context. A program interpreting the address is then unsure what the first field represents. Some clues are needed in the address specification for correct parsing to be possible. Dave Crocker has described a syntax for a similar problem in network access of data [8].

Specific Sugestion

Specifically i suggest that we adopt a field based extensible address scheme where each field is separated from its neighbors by a delimiter character and each field has a name. When an address is specified the name of the most general field must also be indicated.

Definitions:

<address> ::= <field-name> ":" <fields>

<field-name> ::= "NET" | "IMP" | "HOST" | "MESSAGE-ID"

<fields> ::= <field> | <field> "/" <fields>

<field> ::= a decimal number

Examples:

NET:1/3/5/7 names message-id 7 at host 5 on imp 3 in network 1.

HOST:6 names host 6 on whatever imp this message originates on.

One might ask: What is all the fuss about, isn't this a non-problem?, The answer is: Almost. There are very few places where any real difficulties arise, but we have to change the way we think about host addresses. The places where there is a problem are typically little used, except one. The place where humans will see a difficulty is in the TIP "open" command [9], and to a lesser extent the user Telnet and user FTP "connect" commands. Other places are in the MAIL netaddress field, the FTP "sock" command [10], the Telnet reconnection option [11], and in the NIC maintained list of official host names [12].

Conclusion

The suggestion is that we adopt field based extensible addressing to provide for growth in three ways:

(1) growth of the number of hosts and IMPs by allowing these fields to grow in size independently of each other;

(2) growth in scope by the addition of fields on the left to provide for multinetwork systems;

(3) growth in fine structure by addition of fields on the right for the implementation of hosts as mininetworks.

References

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[9] Malman, J., "User's Guide to the Terminal IMP," Report 2138, Bolt Beranek and Newman, Network Information Center Catalog Number 10916, Revised March 1976.

[10] Neigus, N., "File Transfer Protocol," RFC 542, Network Information Center Catalog Number 17759, 12 August 1973. Contained in "ARPANET Protocol Handbook," Network Information Center Catalog Number 7104, Revised 1 April 1976.

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[12] [Offfice-1]<NETINFO>HOSTS.TXT

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